ADDITIONAL NOTES ON *PERIPATUS LEUCKARTI.*

By J. J. Fletcher, M.A., B.Sc.

In the *Proceedings of the Royal Society of Victoria* for 1889 (p. 50) Mr. Dendy gives an account of all the Victorian specimens of *P. leuckarti* which had up to that time come under his notice, and he summarises all that was known about the species. I propose now to supplement Mr. Dendy's paper by some account of about forty specimens obtained, since I last had occasion to offer any remarks on the subject, from three new localities in New South Wales, viz., Mt. Kosciusko, the Blue Mts., and Dunoon on the Richmond River.

The specimens exhibit some variety in pattern and coloration independent of size or sex (as far as the material goes), but from the constant presence of fifteen pairs of walking legs (the legs of each individual have been counted), the presence of an accessory tooth at the base of the main tooth of the outer blades of the jaws, &c., I can only regard them as referable to one and the same species.

I also take occasion to record the occurrence of the species in Tasmania, Mr. Masters in looking through the invertebrates in the Macleay Museum having recently found a rather bleached specimen with fifteen pairs of walking legs which must have been in the collection for at least ten years.

Specimens from Mount Kosciusko.

Thirty-five (18 ♂'s, 17 ♀'s) specimens in the collection of the Australian Museum have been examined. They were obtained by Mr. R. Helms in March, 1889, while on a collecting expedition for the Museum, and were exhibited at the July Meeting of this

Society by Dr. Ramsay who subsequently by kind permission of the Trustees allowed me to examine them. In his "Report of a Collecting Trip to Mt. Kosciusko"* Mr. Helms refers to these specimens in the following words: "But perhaps the most interesting contribution to my collection was made on Sunday, March 10th, in the shape of a specimen of *Peripatus*. This interesting find was later on augmented by two others, and one specimen was obtained on the 19th at an elevation of at least 5700 feet. This is the highest altitude at which I have met this interesting Myriapod, and as far as I am aware none have been previously found at such an elevation. It must be remembered that this locality for at least from four to five months [in the year] is frequently covered with several feet of snow. During my stay there I experienced several frosty nights. After a few rough and cold nights, which made insects scarce, I shifted on the 23rd to a well sheltered place called Wilson's Valley, at an altitude of about 5000 feet and stayed there for the remainder of my time. Being favoured with exceptionally fine weather for the time of the year, I was lucky enough to obtain in this locality many fine insects, ... and the greater number of the *Peripatus* was also obtained here, but only one variety which I did not get amongst the four specimens from the higher altitude."

Apart from the fact that this is the largest number of specimens yet obtained in any one locality, and from their occurrence at high altitudes, the collection is interesting for an usually large proportion (about 50 per cent.) of males the characters of which will be referred to later on.

Before Mr. Helms's visit it would certainly not have occurred to everyone that under existing conditions Mt. Kosciusko was an unusually favourable neighbourhood in which to look for *Peripatus;* but bearing in mind the archaic characters of Peripatus, and what the geologists tell us of the probability that "the eastern portion of the continent during the Lower Tertiary Period must have been submerged to the extent of about 4000 feet below its present level

* Records of Aust. Mus., Vol. I., No. 1, p. 11.

leaving only the higher parts of the Cordillera standing out as a chain of islands which have probably never been wholly submerged since the commencement of the Mesozoic era, and whereon have survived the Cycads, Araucaria, and other ancient vegetable forms which now abound in Australia; the living *Ceratodus* of Queensland and the Marsupialia also point to the same conclusion,"* one need hardly be surprised to find Peripatus here even as an aboriginal inhabitant and not merely a recent immigrant from lower levels, or, remembering that Peripatus though chiefly tropical or subtropical yet occurs in New Zealand, should also be able to maintain itself here in spite of the bleakness and winter snows of Mt. Kosciusko.

The specimens form a series in which at first blue is the predominant colour, red (or its equivalent orange or yellow) being present only in an infinitesimal amount, but the latter by gradational increments finally gains the ascendency, largely but not altogether displacing the blue, and giving rise to an unusually distinct pattern of longitudinal stripes. For convenience they may be considered in four groups, but there are again also slight gradational forms among the specimens in groups (b) and (c), and the passage from group (c) to (d) is a little more abrupt than in the case of the others.

(a) To the naked eye appearing dark blue. Antennæ blue. A median longitudinal intensely dark blue linear stripe with a fine microscopic longitudinal sometimes interrupted line free from pigment down the middle of it; the rest of the dorsal surface except for some pale-coloured primary papillæ in more or less longitudinal series, and the outer surface of most of the legs except for some minute patches of orange in the ground colour of some of them, a dull dark indigo blue due to the presence of dark blue papillæ on a slightly paler blue ground colour; the ventral surface of the body and of the legs even to the naked eye of a noticeably paler blue, the papillæ on the former especially being further

* C. S. Wilkinson, "Notes on the Geology of N.S.W." (1887), p. 53.

apart, and the ground colour paler, in places sometimes colourless. The pale-coloured papillæ are pale blue or more or less colourless, wholly so, or all but an apical portion, or only a basal portion, with usually just an apical pale spot; when conspicuous they are seen to be chiefly arranged in four longitudinal series on each side of the median dorsal line; though not so conspicuous as in the forms in which there is relatively more orange, they are generally recognisable, and their arrangement is as follows:—(1) on either side of and rather close to the median dorsal line commencing on the head a row the papillæ of which are separated by intervals of three transverse ridges; usually in addition between the first row and the median line an inner row of similar papillæ commencing some little way behind the first, the papillæ of which also occur at intervals of three ridges, and alternating with the former, a ridge on which there are chiefly secondary papillæ intervening between every two alternating papillæ; if most of the papillæ are uniformly pale there is then a double or alternating row of them, but sometimes the papillæ in only one row, or in parts of the body are pale; (2) still further out on each side a similar double (or single) alternating series; one of these rows quite anteriorly bending in towards the first-mentioned row; the papillæ of this, of the preceding, and of the next series, when present, on the same transverse ridge; (3) again still further out on each side a more interrupted series consisting generally of two papillæ, one behind the other, over each leg; and (4) a series of irregular lozenge-shaped groups (in outline) of about half a dozen or more papillæ (one or two papillæ on each of about six consecutive ridges) just above the intervals between the legs: some only of the papillæ in some of the lozenge-shaped groups show a tinge of orange or yellow, the others being pale blue, while sometimes the papillæ of a whole group are dark blue; orange may also be present in one or two very small patches on the ground colour of the outer surface of a few of the legs towards their base. These specimens therefore are almost entirely blue, and though not one of them is absolutely without at least a tinge of orange somewhere in one or other of

the situations named when examined in a strong light, yet it is excessively small in amount.

Three specimens.

(b) In general appearance like the foregoing ; for though there is in these a not inconsiderable addition of orange (or yellow) it is so inconspicuous, occurring in very small and for the most part isolated areas, as to be almost inappreciable by the naked eye. This additional amount of orange makes its appearance on (1) the basal portions of some of the pale papillæ ; (2) in the ground colour of the alternate ridges bearing chiefly secondary papillæ ; and (3) in the ground colour of the legs. Not on all the papillæ, however, either in the lozenge-shaped patches or elsewhere is orange present ; some in both cases are still obviously pale blue. On the dorsal surface orange is present round the bases of some of the secondary dark blue papillæ on the ridges which alternate with those bearing the pale primary papillæ, either as a small ring, or it may encroach a little more so as occasionally to join the similarly coloured area of a contiguous papilla, but considerable patches are not formed as in specimens in which there is relatively still more orange ; not all the papillæ on a given ridge however have orange round their bases, though quite a number with orange may occur consecutively, and the number of secondary papillæ so modified is greater than the number of pale papillæ on the alternate ridges ; an increased amount of orange is not so noticeable towards the extremities of the body as in the intervening region. The orange on the legs is very noticeable, the patches being somewhat larger, more numerous, and more of the legs show them.

Fourteen specimens.

(c) Orange or red is present in sufficient quantity to be readily perceptible to the naked eye, and to give something like a definite pattern ; the difference between these and the foregoing ones being due to the increased amount of red with a corresponding increase in warmth of tint which affects both the papillæ and the ground colour, and in addition the antennæ and the ventral surface also ;

and the extremities, especially the tail. Antennæ showing red on some of the basal rings, and on an occasional distal one. The longitudinal rows of papillæ very distinct, not only the ground colour surrounding their bases but the papillæ themselves in most cases now distinctly red; much red about caudal end; on the alternate ridges with small papillæ many of the latter also are red, and in the ground colour red has also increased in amount to such an extent that for a considerable distance on a given ridge the entire surface (both papillæ and ground colour), may be entirely red, such a red patch at length alternating with a blue patch (both papillæ and ground colour blue); red predominates on either side of the mid-dorsal line for some distance, then blue between this and the series of lozenge-shaped patches, but alternate light and dark bands are not otherwise indicated; the lozenge-shaped patches are now very distinct, usually the whole patch (not merely the outline), papillæ as well as ground colour, red. The legs show an arrangement of alternating rows of blue papillæ and orange papillæ, the same tints alternating in the ground colour. On the ventral surface there is a considerable increase in the amount of orange, the ventral surface generally in consequence appearing paler than in the preceding groups, many of the primary papillæ together with the immediately surrounding area orange, the ground colour largely blue more particularly on either side of a rather broad median paler band in which orange predominates (and in which are included the pale areas to be mentioned subsequently).

Fifteen specimens.

(d) Antennæ almost entirely blue; red papillæ on a few of the basal rings, a few specks of red elsewhere, and some red between some of the antennal rings. A well-defined median dorsal longitudinal linear dark blue stripe, bordered on either side by a rather broad longitudinal red band; each of these bordered externally by a similar dark blue longitudinal band of nearly equal width; beyond each of these another longitudinal red band like the first, its outer margin reaching the bases of the legs; the bands are broadest in the middle region of the body, and taper a little

towards the extremities: the intervals between the legs form another interrupted longitudinal band with a predominance of blue. The pattern as described above is readily visible to the naked eye, the arrangement of the bands and their well-defined character being very striking. Under the microscope it is seen that there are a few blue-tipped papillæ and little dark bits of ground colour in the red bands, and papillæ with red bases in the blue bands; and that the bands are not quite so perfectly defined, or their margins quite so straight as they appear to the naked eye. On the legs the ground colour is blue, the papillæ chiefly red with more or less of the apical portion blue. On the undersurface there are chiefly red papillæ with blue ground colour, but with the red on the bases of the papillæ invading the blue in places, and with an indication of pattern as follows: a median ventral interrupted series of rather broad irregular patches corresponding with the intervals between the consecutive pairs of legs blue (primary papillæ are few or absent here), bordered on either side by an area in which are red primary papillæ and irregular blotches of ground colour with scattered patches of blue ground colour; in the median ventral line between the legs of each pair there is a series of blotches of red, in which are the pale areas to be referred to later on; thus up the median line there is a series of alternating irregular blue and red patches, bordered on either side by an area in which the two colours occur together, red primary papillæ with more or less of surrounding ground colour red being present with patches of blue ground colour and a few blue secondary papillæ; the whole ventral surface might be described as mottled. The inner surface of the legs shows chiefly red papillæ as before on a blue ground colour; the spinous pads and the foot blue; a little patch of red proximally on the outer side of foot.

Two specimens.

Specimens from the Blue Mts.

Two specimens, one found by Mr. A. G. Hamilton, who most generously gave me his specimen, under a stone at Govett's Leap,

the other by myself under a log by the road-side near Wentworth Falls. These are the first specimens recorded from the Blue Mts., though several of us for some years have been on the look out for it. I have myself on previous occasions looked within a few feet of the exact spot on which I found my specimen which was the only one I could find after prolonged and careful search, and Mr. Hamilton fared no better. The bush fires prevalent during the dry season of 1888-89 have doubtless not diminished the difficulty of finding specimens.

(a) A very dark specimen, to the naked eye when alive almost dull black, but in a good light a median dorsal longitudinal linear intensely dark stripe, and scattered light coloured papillæ, more particularly light blue ones were visible. Under the microscope or lens there are visible intensely dark blue papillæ so dark as to be almost black, dark papillæ with the basal portion red, pale blue papillæ with sometimes the basal portion red, and dull brick or rusty red papillæ, variously arranged on a dark background, lighter than the darkest blue papillæ and not or only slightly invaded by red: the light blue papillæ occur in two single rows on each side of the dorsal mid-line corresponding with the outer row of each of the two dorsal zig-zag rows in the first three groups of the Mt. Kosciusko specimens, and in two lateral rows rather close together above the bases of the legs; the papillæ of each of these rows are closer together than in the case of the dorsal rows, and they are not so straight as the latter; with a few red papillæ they are all that represent the third or dorso-lateral row, and the lozenge-shaped patches above the intervals between the bases of the legs; on the alternate ridges are some secondary red papillæ, but there is little or no red in the ground colour. On the legs the first ridge shows a good deal of red, but the rest of the outer surface exhibits dark papillæ with fewer red papillæ on a dark ground colour. The undersurface to the naked eye is as usual much paler; the majority of primary papillæ are wholly red, of the smaller ones blue, the ground colour blue, the general effect produced being mottled but without any definite pattern; the inner surface of the legs much

like the ventral surface; about the head there is a marked predominance of blue papillæ; about the caudal extremity there is an admixture of red ones with blue ones. Antennæ dark blue without any red.

One specimen (♀) alive and at rest about 20 mm.; crawling about 30; after drowning 28 mm.

(b) A red specimen longitudinally striped with very dark blue. Antennæ to the naked eye appear nearly uniformly dark, but with much very inconspicuous red on the rings except the distal ones. A median linear longitudinal very dark, almost black, stripe visible to the naked eye; the rest of the dorsal surface on each side of this line divided into three longitudinal bands, of which two are brick red, these being separated by an intervening imperfect dark band; the general pattern is thus very similar to that of group (d) from Mt. Kosciusko, but with the outer dorsal dark band on each side not so well defined and more incomplete; in the red bands the papillæ are with few exceptions entirely red with here and there a patch of dark ground colour; in the dark bands many of them have their bases red, and more and larger patches of ground colour are dark rendering the bands somewhat diffuse and patchy; in the intervals between the bases of the legs of each side as on the outer surface of the legs there is again red mixed with darker papillæ and patches of ground colour, but with red predominant, in this respect differing from the longitudinally striped Mt. Kosciusko examples, in which on the legs externally blue is predominant. Undersurface paler than dorsal surface; chiefly red, with a few dark papillæ and specks or patches of similar ground colour; about the head there are more dark papillæ than elsewhere.

One specimen (♀) alive and at rest 15 mm.; crawling about 21 mm.; after drowning about 33 mm.

In this specimen we get a maximum of red not only in regard to the papillæ but also the ground colour. It agrees in many respects with the redder of two specimens obtained in Nov., 1888,

at Burrawang [*vide* P.L.S.N.S.W. III. (2), p. 1560]; in that specimen however the longitudinal striping was not so marked, the median dorsal longitudinal linear dark stripe was nodose as in Illawarra specimens, each enlargement being bordered on either side by a sub-triangular red patch, the outer dark dorsal bands are indicated by a series of patches, the red bands have more dark tint in them (dark-tipped papillæ and specks of dark ground colour).

Specimens from Dunoon, Richmond River.

During a month's collecting, the weather being more or less unfavourable during greater part of the time, Mr. Helms obtained for me six specimens, of which one disappeared in course of transit. I received three living and two spirit specimens.

The light coloured antennæ of these specimens at once attract attention. The body to the naked eye appears dark brown; there is a good deal of red (or in some it is rather ochreous) which is chiefly confined to the papillæ, but most of the primary papillæ now show it (except the apical portion); while the blue is intensely dark. The dorsal surface on each side of the median longitudinal linear intensely dark stripe in two of the specimens (♂) when alive showed indications of three fairly defined longitudinal stripes, the first one with more dull rusty or ochreous-red in it appearing reddish-brown, then a darker brown band, then again a lighter band like the first, the difference being due to the prevalence in the lighter bands of papillæ with red bases, the red of which sometimes invades the ground colour, while in the darker bands there are more wholly dark papillæ; in the third specimen (♀) when alive the greater part of the dorsal surface was more uniformly tinted like the dark bands in the other two, though the outer light bands were indicated; lozenge-shaped patches are not very well defined apart from the outer lighter band. The outer surface of the legs like the dark portion of dorsal surface. The ventral surface of the body as usual paler than the upper surface, mottled with blue and red but usually the blue predominates in the median line corresponding with the intervals between the consecutive legs, and

about the head; the inner surface of the legs like the ventral surface; the spinous pads blue; a considerable patch of red externally at the bases of the feet. The antennæ are almost entirely red, dusky at the base and near the tips and sometimes on the under surface, but the red predominates.

Two specimens (♂) crawling about 24 mm.; one (♀) crawling 44 mm., after death in corrosive sublimate 23 mm.

From the examination of the above specimens the following considerations seem to follow: (1) the prevalent colours are indigo blue and red, either of which may predominate, the former passing into black in some specimens and the latter into orange or yellow: (2) there is a median longitudinal dark (*i.e.*, blue or its equivalent) linear stripe running down the back in the middle of which is a fine microscopic sometimes interrupted line free from dark pigment: (3) the pattern on the rest of the dorsal surface is a more or less satisfactory indication of light and dark longitudinal stripes, most conspicuous in specimens with a maximum of red.

As regards colour the blue is brighter and more striking in the specimens from Mt. Kosciusko than in any others I have seen. They present some differences in detail in regard to the intensity of the prevailing blue tint both in different specimens and sometimes in different parts of the body in the same specimen, more especially on the ventral surface; such differences are probably in some measure due to the action of the spirit; as spirit exerts a considerable amount of bleaching power on both blue and red. During life they were all probably darker in colour than they are now.

The median longitudinal dorsal dark linear stripe is without the nodose character so common in Illawarra specimens in which it is very striking when the rest of the dorsal surface is not very dark. Down the middle of it there seems to be in all cases a very fine sometimes interrupted microscopic line free from pigment. This of course is only another way of speaking of it as a light or white line edged with black. I prefer the former because the

dark line, especially in specimens with a maximum of red, is conspicuous to the naked eye whereas the light line is microscopic; moreover as far as my experience goes it is more conspicuous after the animal has been placed in spirit, and I have seen living specimens in which in parts of the body it seemed to be wanting or obscured by pigment; but even in spirit specimens it is possible to find cases in which it is absent on some of the ridges.

As regards pattern the differences between the Victorian specimens examined by Mr. Dendy and the specimens examined by me are more marked than in the case of the colour. Mr. Dendy says (*l.c.* p. 61): "There is a thin median light line down the dorsal surface. The characteristic pattern on the remainder of the dorsal surface is a series of segmentally-arranged diamond-shaped patches, in which the red colour is predominant. In some cases viz., the darkest specimens these patches are represented only by a row of small, light coloured, yellow or red spots on each side of the middle line. Each of these spots is situate in the position of the apex of each triangular half of one of the characteristic diamond-shaped patches found in other specimens." I have seen only one Victorian specimen, my original one from Gippsland, which since it had been dead for at least a week (fortunately in dry cold weather) before I received and put it into alcohol is not in first-rate condition; nevertheless in places it still shows fairly well a series of dorsal segmentally-arranged diamond-shaped patches just as Mr. Dendy describes. I have, however, never seen a specimen from this colony with a similar pattern. Those that come nearest to it are the ordinary specimens from Illawarra, but in these the median longitudinal linear dark stripe is nodose, or presents a series of enlargements, one to each pair of legs, and on each side of each of them is a small triangular or diamond-shaped patch of red, while laterally just above and corresponding with the intervals between the legs on each side of the body is a series of diamond-shaped patches of red, which seem to be absent in Victorian specimens. Hence it seems to me that while the statement that "the characteristic pattern on the rest of the dorsal

surface is a series of segmentally-arranged patches in which the red colour is predominant" may be given as a character of the species as it occurs in Victoria, it does not apply to the species without qualification. Mr. Tryon speaking of Queensland specimens says "the colour is very dark blue, almost black, with a few rust-like specks here and there, and lighter coloured beneath; or dark fuscous, with a still darker line along the back." Three very dark specimens given by Mr. Tryon to Dr. Haswell, which I have had the opportunity of examining, may be briefly described as follows:—

As in the dark specimen from the Blue Mts. the red is entirely, or almost so, confined to the papillæ; one shows primary papillæ (the basal or all but an apical portion) red on ridges alternating with others on which there are more numerous secondary papillæ frequently entirely red, a number of them often occurring consecutively, with indicated but not very well defined lozenge-shaped patches above the intervals between the legs: a second has fewer secondary papillæ red; while the third has extremely little red anywhere, and may very well be described in Mr. Tryon's words as " very dark blue, almost black, with a few rust-like specks here and there." Hence though in these there is certainly no very striking indication of a pattern of longitudinal stripes, neither do I see that such light coloured papillæ as are present represent, or have any relation to, segmentally-arranged diamond-shaped patches.

It seems to me, therefore, no longer doubtful that constant specific characters are not derivable from the pattern and coloration of *P. leuckarti;* and it is worthy of note how, as more material comes to hand, specimens from widely distant areas sometimes are found to present characteristic variations in these particulars, whereas specimens from almost the same spot in other localities may exhibit almost the extremes of variation, though it is possible that in such cases bigger series of specimens would give gradational forms also.

When preparing his Monograph Mr. Sedgwick had for examination only two specimens of *P leuckarti*, one of each sex, both of

them much contracted and with the feet bent ventrally, making satisfactory investigation difficult. He was however able to make out in the male the presence of "a rounded white papilla on the ventral face of the fifteenth leg, on each side of the genital opening."

Mr. Dendy out of thirteen specimens met with only one male, not a very satisfactory specimen, and he also speaks of the presence of a small white papilla on the ventral surface of each leg of the last pair.

On examining the specimens now in review it soon became probable that the collection contained an unusually large proportion of males, though what I took to be such had not precisely the characters mentioned by Sedgwick and Dendy; that is to say I was able to pick out a number of specimens, all of them small, with not prominent genital papillæ, and with papillæ, generally whitish, on the ventral surface of some or all of the legs, with the exception of those of the first pair, but not merely on the legs of the last pair only. And this state of things I found to obtain not only in specimens from Mt. Kosciusko and Dunoon, but also in three specimens from Queensland lent me by Dr. Haswell who received them from Mr. Tryon, and in one from Illawarra given me by Mr. A. G. Hamilton. The presence or absence of papillæ seems to be a matter of little importance. In some specimens they are recognisable on all the legs with the exception of those of the first pair; in others only on some of these; the first two pairs (on the second and third pairs of legs) are generally quite conspicuous, as also are those on the posterior seven or eight pairs of legs with the exception of the last pair; the legs on which they most frequently appear to be wanting or on which it is most difficult to identify papillæ or pores, if present, are the 4th and 5th and one or two succeeding pairs, and the 15th pair; sometimes they are not equally conspicuous on both legs of the same pair; in the male of group (d) from Mt. Kosciusko unusually large papillæ are present on each leg of the posterior nine pairs except the first and last leg but one on one side of the body on which they are rela-

tively insignificant, while on legs in front of the seventh pair neither papillæ nor pores are visible; in one specimen the legs of several pairs have each two papillæ, one above the other; sometimes the appearance of a papilla is exaggerated by the proximal portion of the duct of the crural gland being slightly everted; but I have never yet seen a specimen in which papillæ were present only on the legs of the last pair. Not all the legs even of the same specimen are equally favourable for examination, but in well preserved specimens even when papillæ are not recognisable the apertures of the ducts of the crural glands sometimes are.

The papillæ are round, usually whitish but sometimes not different in colour from the surroundings, slightly post-axial in position, and are situated near the base of the leg slightly external to the nephridiopore. Mr. Sedgwick says: "It (the papilla) is in the same position with regard to the leg as the corresponding structure in the Cape males." (Monograph, Q.J.M.S. XXVIII, p. 464), *i. e.*, "on the second row of papillæ counting from the innermost pad" (l. c. p. 448). In the specimens examined by me the papillæ are located nearer the base of the leg than this, on about the fifth-seventh row of papillæ above the innermost pad (*i.e.* about the third or fourth ridge below the nephridiopore); I have never seen them so close to the pad as the second row.

As was to be anticipated sections showed crural glands to be present; and as in *P. capensis** each crural gland consists of a dilated vesicular portion placed in the lateral compartment of the body cavity in the leg, and of a narrow duct opening to the exterior, on one of the papillæ in question. As some of the specimens show papillæ on all the legs but those of the first pair, it is a reasonable inference that in the males of *P. leuckarti* a crural gland may normally be present in each leg but those of the first pair. On the other hand the presence of two papillæ on some of the individual legs in one specimen, together with the occasional absence of both papillæ and pores [as in the last pair of legs of each of two males of which sections were cut] shows

* Memorial Edition of Balfour's Works, Vol. I. p. 905.

that as in *P. Edwardsi* these organs, whose function is unknown, are liable to some variability.

In the females papillæ are not present; nevertheless in this sex it is not an uncommon occurrence to find on most of the legs pale, frequently somewhat curved, slit-like pits or depressions commencing just beyond about the second papilla-bearing ridge below the nephridiopore and crossing the next one or two ridges; occasionally some of them look very like pores. Their appearance, their position (fairly corresponding in this respect with the papillæ of the males), and their number (for they may be visible on all the legs but those of the first pair) naturally suggest the possibility at least of rudiments or relics of crural glands. At present I can offer no evidence in favour of such a supposition as in a number of sections comprising portions of two females no crural glands such as occur in the males were present, nor could I find any trace of them.

Though I have had plenty of material to look at, I have not had enough for purposes of dissection and section-cutting to make out these and other details; and the series of sections of two males and two females at my disposal, partly from the condition of the material and partly from the want of suitable laboratory appliances are not complete, and in some respects leave a good deal to be desired.

In *P. capensis* the crural gland of each leg of the last pair is enormously enlarged and prolonged forward as a long tubular gland, seen in section lying above the nerve cord in each lateral compartment. My two males were chosen at random chiefly because they were less bent than usual, and as it happens each of them is without crural glands in the last pair of legs; but one of them has the glands of the fourteenth pair of legs enlarged, and in the other two pairs are enlarged, those of the thirteenth and fourteenth pairs.

As in *P. novæ-zealandiæ* nephridia are not present in the legs of the last pair.

Of the (spirit) specimens from Mt. Kosciusko some are variously bent making it difficult to measure them ; allowing for this as nearly as possible they may be said to vary in length from about 9-18 mm., not including the antennæ ; with two exceptions the smaller ones are males, which average about 10 mm. long, the two largest being about 13 and 14 mm. respectively ; the two young females however are easily distinguishable from the males by the characters of the genital papilla and aperture, and the absence of papillæ on the legs. Of the five specimens from Dunoon two females were, apart from their greater size, similarly readily distinguishable from three males.

The genital papilla of the female is very frequently remarkably prominent (more especially post-mortem) and bears a longitudinally disposed slit ; in the large dark specimen from the Blue Mts. however, as occasionally happens, the genital papilla is not relatively more prominent than is usual in the males. In the latter each lip of the otherwise longitudinal slit is usually notched, so that the aperture appears cruciform, and with a conspicuous large and one or two smaller blue papillæ in each re-entering angle generally visible in favourably preserved specimens gives a very characteristic appearance. In addition to the three differential sexual characters in respect of size, the characters of the genital papilla and aperture, and the occurrence of papillæ on certain of the legs, which have already been mentioned, and which were first pointed out by Mr. Sedgwick, I am able now to mention another in the occurrence in the males of a pair of pores, sometimes slightly crescentic in shape, one on either side of and close to the median ventral line between the genital papilla and the anus but nearer the latter ; I do not at present know the significance of these pores as my sections are not good enough to enable me to follow them up ; possibly they may be the openings of the ducts of accessory glands. I do not know of any other external differences characteristic of the sexes.

On the ventral surface is a median series of pale areas which seem pretty constantly present (though they are not visible in one

specimen from Illawarra). There is one of such areas between the legs of each pair except the last, but more frequently in addition there is a second one in front of each of these. They are sometimes larger than at others, but they occur in both sexes. They are placed chiefly in the furrows but the paleness extends also on to the ridges. Mr. Dendy calls attention to them, and Saenger also evidently noticed them for fig. 31 of Pl. XIII., illustrating his paper is a figure showing a ventral view of so much of the hinder portion of the body as includes the last two pairs of legs, and a reference line marked *gm* points to what is evidently intended for the pale area between the legs of the last pair but one. The explanation of the figure is in Russian, but Professor Stephens has kindly translated that portion of it relating to *gm* as "bare spots observable between each pair feet in medial line." I am unable at present to throw any light upon the subject of their import.